

ENERGY STAR® Draft 1 Test Method for Central Heat Pump Water Heater Systems

Stakeholder Comments & Responses

Topic	Comment Summary	EPA Responses
CHPWH System Complexity/ Configuration	<p>Two stakeholders commented that they are aware of the proposed approach of testing each component individually to create an integrated metric, but due to the highly customized nature of Commercial Heat Pump Water Heating systems, they are concerned this approach would be overly burdensome. They also stated their concern that ENERGY STAR's plan to establish certifications for "Common Configurations" may lead to custom designed systems being excluded from qualification for ENERGY STAR and would prevent them from included in the rebate programs. One stakeholder recommended Energy Star consider a component-based approach combined with the promotion of best practices and performance-based criteria while recognizing variability in system designs dictated by individual project requirements.</p>	<p>The EPA and DOE continue to believe that a component-based approach for testing CHPWHs provides the best balance of testing burden and reliable results available at the moment, though we expect that over time system-based metrics may arise.</p> <p>EPA is planning to propose an approach in the draft 1 specification that will allow for customized systems.</p>
Unfired hot water storage tanks (UFHWST)	<p>Several stakeholders stated that a significant portion of UFHWSTs are custom designed and requiring standardized testing and certification for these customized tanks would be impractical and costly. Stakeholders suggest EPA explore alternative methods such as utilizing software to model performance of customized models based off existing certification information. Several stakeholders also suggest that EPA use metrics such as R-value for insulation instead of requiring testing of every custom tank and system configuration. Stakeholders stated this would provide reasonable estimates of performance while limiting testing burden.</p>	<p>R-value alone may not fully capture the effect of standby loss, which can be an important factor in systems which store large amounts of hot water. Therefore, DOE and EPA will continue to include standby loss testing of UFHWST by referencing GAMA Testing Standard IWH-TS-1. In continuing to evaluate the ENERGY STAR specification, DOE and EPA may consider allowing the use of an AEDM for UFHWSTs to allow for reduced test burden for similar product families.</p>

<p>Ducted vs Non-ducted</p>	<p>Several stakeholders stated that for CHPWHs that offer ducted configurations, testing in the ducted configuration should be optional. They also commented that mandating testing in ducted configurations would create "ducted specific" models that will increase market complexity in a negative way for the consumer and increase testing burden for manufacturers. One stakeholder commented that the ducted configurations are atypical, and that testing in ducted configurations would serve to penalize those units.</p>	<p>DOE and the EPA agree with stakeholders that ducted configurations are atypical, especially for units that are installed in outdoor conditions. Therefore, the test procedure has been adjusted such that testing in the ducted configuration is optional for outdoor units. However, there is an additional test and metric for units that can be installed indoors to represent their indoor performance (Indoor COP at 80.6) and is requiring that indoor-only units use this metric. When conducting the indoor COP test, the unit must be configured in the ducted configuration as this is more representative for indoor applications.</p>
<p>Test Conditions</p>	<p>Several stakeholders commented that the EPA's proposal of entering air temperatures does not accurately represent the temperature that CHPWHs would spend most of their time operating in. These stakeholders recommend that EPA re-evaluate the conditions and adjust the test points to better reflect this. Specifically, there was a concern that there was too significant of a gap between the 50 and 17 test points, which would fail to distinguish products that have minimum temperatures within that range (e.g., 49 and 25). Two stakeholders recommended EPA adopt a minimum temperature test labeled "Min", which manufacturers would select based on the equipment capability. This method would allow for manufacturers whose units cannot operate at the two lowest temperature tests, to obtain a rating at their units' minimum operable temperature. One stakeholder recommended EPA align the evaporator entering air temperatures with those that are eventually prescribed in AHRI 1300.</p>	<p>DOE and EPA agree with stakeholders that the air source evaporator air test condition temperatures in Draft 1 did not represent the temperatures that CHPWHs would spend most of their time operating in. Therefore, the test conditions for outdoor units have been adjusted to the following: 95F, 67.5F, 47F, 35F, 17F, and 5F, in line with stakeholder recommendations. An additional test condition unique to indoor CHPWHs was maintained at 80.6. A minimum operating temperature test point was also included, which is only required for units that cannot conduct the 35F and 17F test.</p>
<p>Seasonal Metric</p>	<p>One stakeholder endorses EPA's initiative to develop a test method for CHPWHs and hopes that EPA will use insights from NEEA's Advanced Water Heating Specification (AWHS) to inform their metric. Several stakeholders had concerns about an integrated efficiency metric and requested that EPA and DOE do not move forward with developing a seasonal metric outside of AHRI's development process. Several Stakeholders stated that the water heating market is not accustomed to seasonal metrics, and that developing one hastily will lead to market confusion. Stakeholders commented that the AHRI 1300 group will be addressing the metric items DOE and EPA identified and encourages DOE's participation in the group.</p>	<p>EPA and DOE have determined that a Federally defined seasonal metric will best serve the growth of the central HPWH market, because it can be leveraged by different incentive programs. The seasonal metric in the Final Draft test method is comparable to other developed seasonal metrics in the space-heating industry such as Room heat pumps, Residential air-source heat pumps, and commercial unitary heat pumps.</p> <p>DOE and EPA continue to monitor and participate in the progress of the AHRI 1300 committee and will seek alignment where appropriate.</p>

Compressor Cut-in/Cut-out	Two stakeholders recommended EPA collect and report the minimum and maximum operating ambient temperatures for the compressors. One stakeholder noted that at high temperatures compressors may experience performance issues, so an extrapolated increase should not be assumed. And suggested assuming electric resistance operation above the upper compressor cutoff temperature.	The EPA and DOE have adjusted the test method to request compressor cut-in and cut-out temperatures and includes a low-ambient compressor cut-in and cut-out test. The EPA will address potential inclusion of high ambient compressor cut-out reporting in the draft 1 specification.
Entering Water Temperature Test Condition	Two stakeholders commented that their studies have found that entering water temperature strongly impacts performance, and they support EPA's proposal to differentiate condenser entering water temperature and temperature rise conditions for single and multi-pass equipment. For single pass equipment, these stakeholders recommended an approach similar to the NEEA's AWHS, but a single entering water temperature is sufficient for multi pass systems due to their operational differences. Additionally, one stakeholder encouraged EPA to consider an optional higher temperature for swing tank system designs at 150° F or 160° F. One stakeholder recommended EPA align the condenser entering water temperatures with those that are eventually prescribed in AHRI 1300.	DOE agrees that varying the entering water temperature for single-pass test conditions based on the evaporator entering air conditions will be more representative. Therefore, DOE has adjusted the entering water temperature conditions to vary depending on the air temperature test condition for single-pass tests. While AHRI 1300 is still under development, these adjustments are aligned with the most recent set of conditions discussed by that committee. At this time DOE is not considering optional higher temperature outlet water test conditions at 150° F or 160° F.
Defrost Test Condition	Two stakeholders encouraged EPA to include an ambient test condition at or near 35°F, due to the majority of California's design temperature being 30-40°F. These stakeholders commented recognizing that this test point would add complexity to the procedure due to defrost, but a template for this test can be obtained from AHRI 210/240. Stakeholder's stated that determining defrost effects is worth the additional testing complexity.	DOE agrees that a representation of performance around 35°F in humid conditions is necessary to evaluate the unit's performance during defrost but is aware that some units may not be able to test under defrost conditions due to lab constraints. DOE has adjusted the test method to include an optional defrost test procedure based ASHRAE 37, which is commonly referenced for defrost in other space heating test methods. For units that can operate in frost conditions, but do not perform the optional defrost test, a default capacity degradation factor is applied to those bins and performance is interpolated within the frost region using the 47F test point and the next lowest test point (either 17F or the lowest specified compressor operating temperature, whichever is higher).
Definitions - CHPWH	Two stakeholders recommended defining CHPWH systems as Air-to-Water and Water-to-Water heat pumps, which would eliminate many of the proposed tests in section 4, since the geo-exchange or ground-source CHPWH market is insignificant.	The EPA agrees that the geo-exchange and ground-source CHPWH market is insignificant, and therefore removed geo-exchange HPWHs from the test procedure.

System Components	One stakeholder recommended redefining the system boundary to add a master mixing valve before the risers and supply trunk, as well as a distribution system balancing method. One stakeholder recommended including indirect water heaters and booster heaters as additional system components within the CHPWH system.	The EPA will address this comment when releasing the first draft specification.
Circulation Pump	One stakeholder suggested that recirculation pump testing may not be necessary but recommended the defining of system configurations. One stakeholder expressed concerns about the availability of CER data and whether that will impact the certification of a future CHPWHs specification.	The EPA will evaluate the availability of CER data and adjust the reported values for circulator pumps if necessary. System configuration definitions will be addressed in the first draft specification.
UFHWST Testing	One stakeholder suggested increasing the measurement interval of the ambient room temperature to 1 minute and requested more guidance on "Mean tank temperature".	DOE has adjusted the UFHWST test method to include these suggested changes.
Climate Bins	One stakeholder recommended calculation be for an entire year at national average ambient conditions and optional representations should be explicitly allowed at each climate zone (e.g., IECC or ASHRAE). They also did not recommend a bin weighting/operating hours approach as important aspects of system operation will be lost. For example, many of the coldest hours may not have any hot water demand meaning heating is not needed or could be delayed.	DOE has adjusted the test method to include climate bins for both the national average and cold climate. Optional representations at each climate zone will increase the number of metrics that can be represented significantly and may cause confusion within the industry. While certain aspects of system operation may be lost using the climate bin method, the seasonal metric offers a fair approach without having more data on the unit's specific application. Data at the specific test conditions may be used in cases where designers are looking to define performance in a specific application, but a seasonal metric allows for simple recognition of heat pump performance.
ANSI/ASHRAE 118.1-2022 References	One stakeholder supported referencing the most recent version of ANSI/ASHRAE 118.1 as much as possible. The stakeholder recommended including sections 6.4, 6.5, 7.4, and 7.7.8 of ANSI/ASHRAE 118.1-2022 which were excluded in Draft 1 as these address gas-fired CHPWHs. One stakeholder requested clarification why DOE proposed a different external static pressure and airflow (nozzle pressure drop) tolerance than is in ANSI/ASHRAE 118.1-2022	DOE and the EPA have adjusted the test method scope to exclude gas-fueled HPWHs. DOE adjusted the different external static pressure tolerances as we noted that transducers are not accurate enough to measure 5% of 0.1 WC which ANSI/ASHRAE 118.1 recommends and for nozzle DP, 2% has been problematic since data acquisition (DAQ) systems have improved.
Interpolating Capacity between test conditions	One stakeholder recommends evaluating linear interpolation of the split-system HPWH efficiency at a particular temperature and converting to heating capacity based on known input capacity.	DOE and the EPA have adjusted the test method to include a seasonal metric which interpolates capacity and power between test conditions to evaluate an overall heating efficiency across a weighted range of temperatures.

Part-Load Testing	One stakeholder did not recommend further testing to evaluate part-load operation. This stakeholder recommends further evaluation of part-load operation be reserved for a future round of the revision when in-field part-load applications will be better understood.	At this time, part-load testing will not be included in the test method. The EPA and DOE may revisit part-load testing in a future test method.
Electric Resistance below Cutoff	One stakeholder recommended using electric resistance efficiency of 98% for evaluating performance below the lower compressor cutoff temperature	DOE and the EPA have adjusted the test method to include a seasonal metric which attributes electric resistance efficiency and performance below the lower compressor cutoff temperature.
Electric Storage Water Heaters	One stakeholder was concerned with the proposed standby loss calculation for electric storage water heaters as it did not account for the consumer electric storage water heater test method. This stakeholder also proposed updates to the equations for calculating standby losses of commercial electric storage water heaters.	At this time, the EPA is not considering consumer electric storage water heaters as within the scope of the CHPWHs Systems TP. The commercial electric storage water heater standby loss calculations have been adjusted based on the suggested feedback.